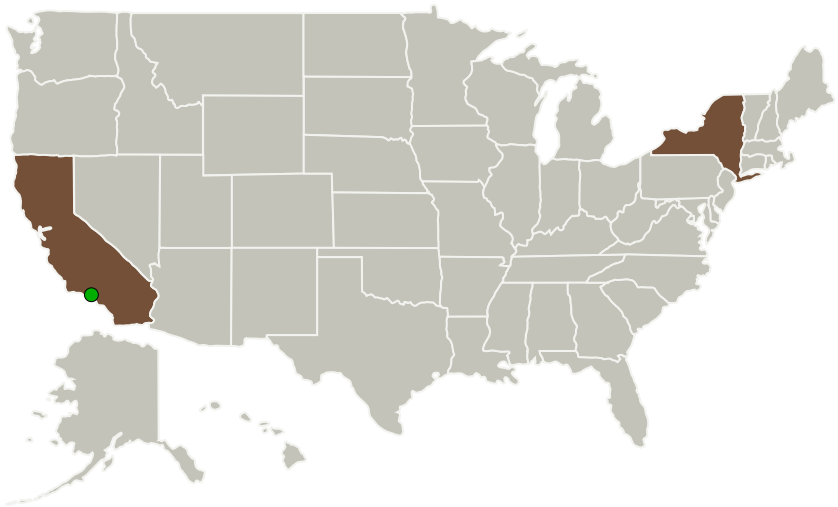
Development of a Hermetically Sealed Canister for Sample Return Missions, Phase II

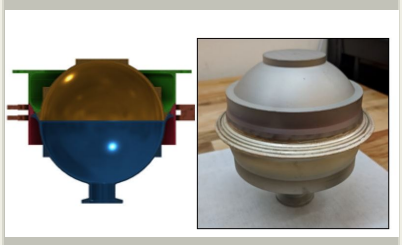
Completed Technology Project (2016 - 2018)

Project Introduction

The goal of this project is to develop hermetic sealing technologies which can be used for the return of samples from planetary bodies such as Mars, the Moon, Comets and Asteroids, with a primary focus on induction brazing as a means of sealing a Mars Sample Return Orbiting Sample (OS) after it has been recovered by the MSR Orbiter spacecraft. During Phase 1, Honeybee Robotics investigated several techniques for providing hermetic sealing such as Knife Edge, Shape Memory Alloy, C-ring, O-ring and Induction Brazing. These were identified as promising hermetic sealing approaches which can be applied to Sample Return (SR) missions, such as the Flagship Mars SR, New Frontiers (NF) Comet SR and the Lunar South Pole-Aitken Basin SR, identified by the NRC Decadal Survey as the primary missions for the next decade. The sealing system would be used to store samples of rocks, soils, atmospheric gas, ice or icy-soil. Based on Phase 1, we determined that a brazing approach is the optimum method of sealing planetary samples and should be used as a primary seal. Knife edges and O-rings should be pursued as secondary and redundant (backup) seals, respectively. Therefore, we propose to design and fabricate hermetic sealing canisters and test their hermeticity to achieve leak rates of 10-7 atm cc/sec He. The canisters will be exposed to dust and thermal cycles to reach TRL 5/6 at the end of the Phase 2.

Primary U.S. Work Locations and Key Partners





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Completed Technology Project (2016 - 2018)

Organizations Performing Work	Role	Type	Location
Honeybee Robotics, Ltd.	Lead Organization	Industry	Pasadena, California
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	New York

Project Transitions

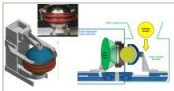
April 2016: Project Start

December 2018: Closed out

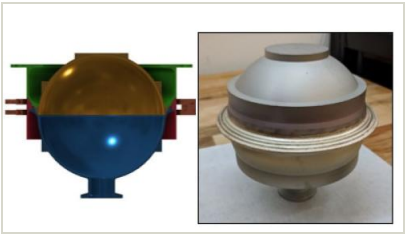
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139677)*

Images



Briefing Chart Image
Development of a Hermetically Sealed Canister for Sample Return Missions, Phase II
(https://techport.nasa.gov/image/130222)



Final Summary Chart Image
Development of a Hermetically Sealed Canister for Sample Return Missions, Phase II
(https://techport.nasa.gov/image/133500)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Honeybee Robotics, Ltd.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Kris Zacny

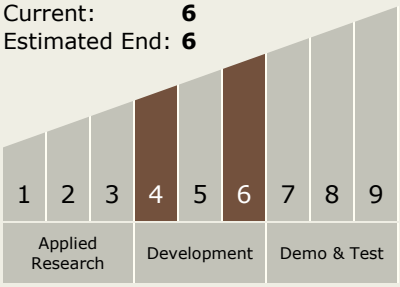
Co-Investigator:
Kris Zacny

Development of a Hermetically Sealed Canister for Sample Return Missions, Phase II

Completed Technology Project (2016 - 2018)

Technology Maturity (TRL)

Start: **4**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX04 Robotic Systems
  - TX04.6 Robotics Integration
    - TX04.6.2 Modeling and Simulation for Robots

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System